

# Benefits of the Great River Energy Project



***Clean Coal Power  
Initiative***

***Demonstration of a Lignite  
Fuel Enhancement System***

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# Executive Summary

- **Demonstration projects are critical to successful commercialization of technology developed under DOE's Fossil Energy R&D program.**
- **Successful commercial application of the Lignite Fuel Enhancement System in the United States would significantly reduce emissions.**
  - 6,890 tons per year of  $\text{NO}_x$
  - 18,360 tons per year of  $\text{SO}_2$
  - 7,084,810 tons per year of  $\text{CO}_2$
  - 9,340 tons per year of particulates
  - 297 pounds per year of mercury
- **As much as \$55 million could be saved by power companies using the Lignite Fuel Enhancement System.**



# Outline

- **Description of the Lignite Fuel Enhancement System.**
- **Quantitative estimates of the benefits of the Great River Energy project.**
  - Benefits to the Nation
  - Benefits to Great River Energy's Coal Creek plant
- **Approach used to calculate benefits.**



# Great River Energy Project

- A 546 MW<sub>e</sub> demonstration of the Lignite Fuel Enhancement System.
- Installed on a PC Boiler with a tangential firing configuration using North Dakota lignite at Great River Energy's Coal Creek Station Unit 1, Underwood, ND.
- Total project funding: \$22,000,000  
DOE share: \$11,000,000 (50%)



Coal Creek Station

# Lignite Fuel Enhancement System

- Uses waste heat to reduce the moisture content of the feed coal.
- Reduces NO<sub>x</sub>, SO<sub>2</sub>, CO<sub>2</sub>, particulate, and Hg emissions while reducing plant heat rate.
- Forecast to be installed on 10.0 GWe of existing coal-fired capacity.



# Advantages of the Lignite Fuel Enhancement System



- Reduces plant heat rate.
- Reduces fuel and maintenance costs.
- Has potential to increase plant generating capacity.
- Reduces emissions of SO<sub>2</sub>, NO<sub>x</sub>, CO<sub>2</sub>, mercury, and particulate matter.
- Reduces make-up water requirements.



# Anticipated Performance at Coal Creek Station

- Overall performance improved by 5%.
- Cost of generation reduced by \$0.70/MWh (\$3 Million per year).
- Less duct erosion and maintenance cost.
- Reduction in fan and mill power.
- Increased reliability: fewer outages.
- 7% reduction in NO<sub>x</sub>, CO<sub>2</sub>, Hg, and particulate emissions.
- 25% reduction in SO<sub>2</sub> emissions.



# Competing Technology Options

- Drying not integrated with plant heat cycle.





# Estimated Reductions in National Pollution Emissions from Commercialization

	Emission Reduction <sup>1</sup> , tons/year	Current Emissions from all Coal-fired Boilers in the United States <sup>2</sup> , tons/year
NO <sub>x</sub>	6,890	4,611,940
SO <sub>2</sub>	18,360	10,773,220
CO <sub>2</sub>	7,084,810	2,133,109,930
Particulate Matter	9,340	522,360
Mercury	0.15	48.6



<sup>1</sup> Basis: 10.0 GWe market penetration

<sup>2</sup> Source: NETL Coal Power Data Base

# Additional National Benefits from Commercialization



- **Lignite Fuel Enhancement System could save \$55 million in operating costs when installed on 10.0 GWe of existing power plants.**

# Benefits of Technology for Coal Creek

Pollutant	Annual Emission Reduction
NO <sub>x</sub>	376 tons
SO <sub>2</sub>	3,580 tons
CO <sub>2</sub>	386,860 tons
Particulate Matter	510 tons
Mercury	16.2 pounds

**Total Emissions at the Coal Creek Plant are estimated to decrease by 7% to 25% due to the installation of the Lignite Fuel Enhancement System.**



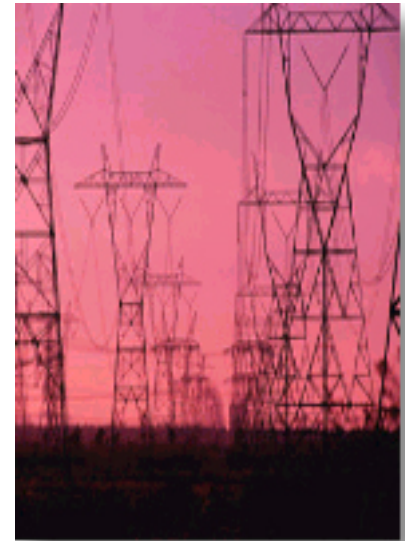
# Additional Benefits for Coal Creek

- The Lignite Fuel Enhancement System is estimated to save about \$3 million in annual operating cost.
- Additional benefits include:
  - Lower maintenance costs
  - Higher availability
  - Potential to increase capacity by 14 MW<sub>e</sub>
  - Reduced ductwork erosion
  - Lower parasitic power



# Approach to Estimating Benefits

- **Forecast market penetration.**
- **Quantify differences between performance of conventional power plant with and without Lignite Fuel Enhancement System being demonstrated.**
  - Pollutant emissions, tons per year
  - Operating costs



# Assumed Market Penetration

- Individual boilers most likely to install the Lignite Fuel Enhancement System were selected from the NETL Coal Power Data Base and UDI data.
- These target boilers were selected based on the use of lignite, subbituminous coal, or a blend of the two.





# Assumed Market Penetration (continued)

- 100,162 MW<sub>e</sub> of total market potential.
- Assumed market penetration of 10% resulting in 10.0 GW<sub>e</sub> of existing power plants selected.



# Differences in Performance

## - Total Emissions-

- Total emissions from Coal Creek Unit 1 are from the NETL Coal Power Data Base.
- Total emissions after installation of the technology on these boilers were estimated by taking the reductions at Coal Creek to be representative.



# Differences in Operating Cost

- For this analysis, the lower operating cost is due to decreased coal demand at a given power output and reduced parasitic power demands.
- Participants data used to quantify savings.
- The cost savings associated with the Lignite Fuel Enhancement System at Coal Creek are multiplied by the assumed market penetration ( $10.0 \text{ GW}_e$  of existing coal-fired capacity).



# Conclusions

- **There are significant benefits to the nation that will be realized by the commercialization of technologies being demonstrated in the Power Plant Improvement and Clean Coal Power Initiatives.**



**Visit the NETL web site for information on all  
Power Plant Improvement Initiative and  
Clean Coal Power Initiative projects.**

**[www.netl.doe.gov/  
coalpower/ccpi](http://www.netl.doe.gov/coalpower/ccpi)**

